ELECTROMAGNETIC TOUCH SENSOR INPUT SYSTEM IN A CATHODE RAY TUBE DISPLAY DEVICE

TECHNICAL FIELD

The present invention relates to cathod ray tube display systems, and in particular to such systems employing touch sensor inputs.

BACKGROUND TO THE INVENTION

Many systems have been proposed to provide operator's inputs in a cathode ray tube display system by providing, at the cathode ray tube screen face, an arrangement sensitive to an operator positioning an object or his finger on the face.

Probably the most well known of such devices is the light pen. This is a light sensitive device which, when placed on a cathode ray tube face, detects the light generated by the cathode ray tube beam as it sweeps past the pen. The position of the pen on the screen can be calculated by reference to the timing of the cathode ray tube beam sweeping. The main disadvantages of the light pen are that it has to be coupled to the display system by a flying lead connector which can prove awkward in use and that it has to be robustly constructed to prevent damage due to dropping.

In order to overcome the disadvantages of the light pen, there have been a number of proposals to provde interactive cathode ray tube inputs by contacting the cathode ray tube face. An article entitled 'Touch Sensitive CRT Screens Join Computers and Nonusers' in Electronic Design, Volume 29, No. 21, Oct. 15, 1981 at pages 61, 62 and 64 summarizes such systems. There may be divided into two general groups, passive devices and active sensory devices.

The passive devices comprise matrices of resistive capacitive elements formed on membranes which are fixed to the face of a cathode ray tube, or circuit elements fixed directly to the face. With the resistive devices, touching a resistive membrane signals the position of the touch by contact between normally spaced resistive surfaces at the touch area via a voltage divider effect. With the capacitive devices, touching one of a pattern of pads on the cathode ray tube face adds the human body's capacitance to that pad, and a circuit detects the change and signals the position of the touched pad. U.S. Pat. No. 3,482,241 shows one form the circuitry used to sense capacitive touch pads. One problem with these passive devices is that they obscure or reduce the brilliance of areas of the cathode ray tube screen.

To avoid this problem, the active devices were developed. As indicated in the above mentioned Electronic Design article, these devices flood the screen with acoustic or light signals. With the acoustic system, piezoelectric transducers positioned adjacent the screen produced acoustic surface waves across the screen. These are reflected by any object touching the screen face and the reflected signals are sensed by the transducers to provide an indication of the position of the object. The optic systems use an array of L.E.D.'s at one side of the screen which generate light beams which are sensed by photo diodes at the opposite side of the screen. In these systems, breaking of the light beams by touching the cathode ray tube face is sensed to provide an indication of the touch position. These active systems are relatively expensive and are subject to ambient signal interference, though steps can be taken to minimize such interference.

U.S. Pat. No. 4,281,323 shows a display touch sensing system which uses ambient electrical noise generated by the display device. In that system, conductive strips are arranged in rows and columns across the face of a display device. In operation of the display device, electrical noise is generated constantly in the strips. When an operator places his finger at the conjunction of a row and a line strip, the amplitude of the noise on these strips changes. This change is sensed to provide an indication of the position of the touch. This system, as it employs lines and pads on the screen face, has the same disadvantage as that of the passive devices described above.

DISCLOSURE OF THE INVENTION

The present invention is based on the discovery that electromagnetic noise generated by a cathode ray tube can be used to sense a touch position on the face of the tube without the use of any sensor devices on the viewable face of the tube.

According to the invention there is provided an electromagnetic touch sensor input system in a cathode ray tube display device comprising first and second elongated conductors respectively positioned along the side edges of the faceplate of the cathode ray tube, third and fourth elognated conductors positioned respectively adjacent the upper and lower edges of the faceplate, said conductors being arranged to pick up electromagnetic noise generated by the cathode ray tube in operation, first circuit means coupled to the first and second conductors and second circuit means coupled to the third and fourth conductors, said circuit means being responsive to electromagnetic noise signals induced in the conductors to provide output signals representative of the location at the cathode ray tube face of an object positioned on or adjacent said face and interfering with said electromagnetic noise.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of the front face of a cathode ray tube with sensing conductors positioned along each side.

FIG. **2** is a side view of the FIG. **1** arrangement.

FIG. **3** is a block diagram of sensor circuits coupled to the sensing conductors of FIG. **1**.

FIG. **4** is a perspective view showing details of a practical implementation of the arrangement shown in FIGS. **1** and **2**.

DETAILED DESCRIPTION

FIGS. **1** and **2** show the arrangement of touch sensor plates around the periphery of the faceplate **1** of a CRT **2** used in a display terminal. Plates **3** and **4** are positioned along the sides of the faceplate, and plates **5** and **6** are positioned at the upper and lower edges of the faceplate. A pair of leads **7** and **8** are coupled respectively to the lower ends of plates **3** and **4**, and a further pair of leads **9** and **10** are coupled respectively to the right-hand ends of plates **5** and **6**. Each plate has a length which corresponds substantially with the length of the adjacent side of the CRT faceplate and, as can be seen in FIG. **2**, a width which allows it to extend in front of the faceplate. As will be seen later in the description of the FIG. **4** arrangement, the plates are conveniently mounted in the front bezel of a cabinet into which the CRT faceplate fits. The width of each plate is